

A Color Variation of *Epirixanthes* Species (Polygalaceae) Found in West Kalimantan, Borneo, Indonesia

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Color variation in *Epirixanthes elongata* Blume and *E. papuana* J. J. Sm. (Polygalaceae), discovered during a botanical survey of Betung Kerihun National Park, West Kalimantan, Borneo, Indonesia, is described and illustrated. Both species are rather common in the area, but the color variation, a form of albinism, was rare and found only once in each species.

Key words: albino, Borneo, color variation, *Epirixanthes elongata*, *Epirixanthes papuana*, Kalimantan, mycoheterotrophic plant, Polygalaceae

Epirixanthes Blume (Polygalaceae) includes only six species (Pendry 2010), distributed from eastern India to China, and throughout the Malaysian region as far east as the Solomon Islands (Meijden 1988). All six species of *Epirixanthes* are known to be saprophytic/mycoheterotrophic and lack chlorophyll. Except for *E. compressa* Pendry from Thailand, the other five species occur in Borneo, the center of distribution and diversification of the genus.

The border area of Borneo between Indonesia, Malaysia and Brunei, known as the ‘Heart of Borneo’, is known for its rich biodiversity, particularly within the tropical rainforests. During recent botanical expeditions arranged by the Research Center for Biology, Indonesian Institute of Sciences (LIPI) in the Kalimantan area of the Heart of Borneo, we discovered a number of new species or varieties of saprophytic and mycoheterotrophic plants (Tsukaya & Okada 2005, 2012a, 2012b, Tsukaya *et al.* 2005, 2011), indicating that the trans-border area of Borneo is indeed a center of diversity for saprophytes.

Among the collections made during expedi-

tions to Betung Kerihun National Park, West Kalimantan (December 2010 to January 2011 and December 2011 to January 2012), we noticed color variants in *Epirixanthes*. *Epirixanthes pallida* Wendt has straw colored stems, but all other species, including the most common species, *E. elongata* Blume, and the slightly less common *E. papuana* J. J. Smith, have purplish stems (Meijden 1988, Pendry 2010). During our expeditions we found albino individuals of each of these species in Betung Kerihun National Park, which we describe below.

Materials and Methods

Observation

The structure of the flowers was observed under a stereomicroscope (MZ16F, Leica Microsystems, Tokyo, Japan).

Results

We found white colored (albino) individuals of *Epirixanthes papuana* (characterized by re-

peated branching of the inflorescence and presence of a bracteole) on 29 December 2010, in the Sungai (River) Kapuas area (collection #HT1016: Fig. 1B) and of *E. elongata* (characterized by a slender, unbranched inflorescence), 28 December 2011, 01°12'55.8"N, 113°02'41.1"E, 204 m alt., in the Sungai (River) Sibau area (collection #219A: Fig. 1E). The albinos were among individuals with normal flowers (Figs. 1C, F). Seven individuals *E. papuana* co-occurred with 15 albino individuals within a 3 × 5 m square area (Fig. 1C). In *E. elongata* only one albino was found among 12 normal colored individuals (Fig. 1F). In both cases, albino individuals were morphologically indistinguishable from normally colored individuals in all characters apart from color.

Discussion

All five species of *Epirixanthes* in Borneo are known to have purple, reddish or purplish-brown coloration in their stems and bracts (Meijden 1988) (Fig. 1A, D), but we discovered albino individuals of *E. papuana* and *E. elongata*. As far as we know, this is the first report of albino forms in *Epirixanthes*. Although *Epirixanthes* is one of the most common genera among mycoheterotrophic/saprophytic plants in Borneo, population sizes of the species are not large, as is usual for many mycoheterotrophs and saprophytes.

Because all six species of *Epirixanthes* are saprophytic/mycoheterotrophic and lack chlorophyll and they have ivory or creamy yellow flow-

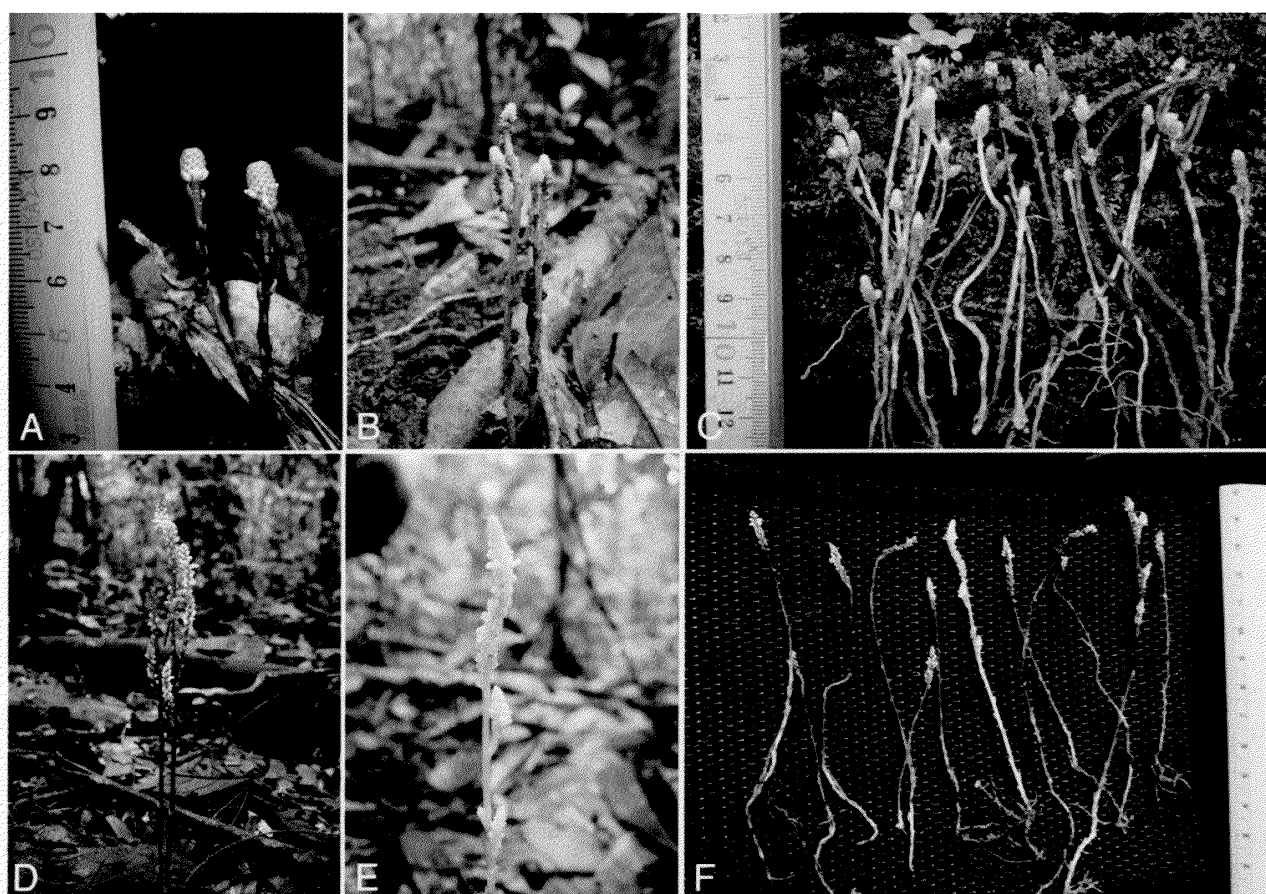


FIG. 1. Albino individuals of *Epirixanthes papuana* and *E. elongata*. A–C, *E. papuana*: (A) typical color form; (B) albino individual; (C) mixture. D–F, *E. elongata*: (D) typical color form; (E) albino individual; (F) mixture (F). Photographs taken 29 December 2010 for panels A–C; 27 December 2009 for panel D, and 28 December 2011 for panels E, F; all in Betung Kerihun National Park, West Kalimantan, Borneo, Indonesia. Scale in cm.

ers, it seems unnecessary for them to be pigmented, yet they all show various coloration, except for the individuals described here. In general, almost all saprophytic/mycoheterotrophic plants are variously colored. Coloration may play a role in their survival within natural habitats, since biosynthesis of flavonoids and anthocyanins are known to be important in plants in general, not only for coloration, but also to protect against ultraviolet radiation, aluminium toxicity and so on (reviewed in Whinkel-Shirley 2002). The fact that some albino individuals grow within the same habitat, however, suggests that there may be no, or little, selective advantage between albino and colored individuals in tropical rainforests; color variation may be considered neutral for species survival. Our findings may present a unique opportunity to analyze the aspects of saprophytic/mycoheterotrophic plants.

Taxonomic treatment

Epirixanthes papuana* J. J. Sm. f. *alba* Tsukaya & H. Okada, *forma nov.—Fig. 1A.

Typus. Indonesia, West Kalimantan: Betung Kerihun National Park, along Sungai (River) Kapuas, ca. 191 m altitude, at 01°00'00.0"N, 113°38'33.8"E, in tropical rainforest (lower hill forest), composed mainly of Dipterocarpaceae, 29 December 2010, *H. Okada, H. Nagamasu & H. Tsukaya HT1016* (Holotype BO, dried specimen with separate flower in 50% ethanol).

Albino form of *E. papuana*, differing only in the coloration. Whole shoot pale ivory.

Epirixanthes elongata* Blume. f. *alba* Tsukaya & H. Okada, *forma nov.—Fig. 1B.

Typus. Indonesia, West Kalimantan: Betung Kerihun National Park, along Sungai (River) Kapuas, ca. 204 m altitude, at 01°12'55.8"N, 113°02'41.1"E, in tropical rainforest (lower hill forest), composed mainly of Dipterocar-

paceae, 28 December 2011, *H. Okada, H. Nagamasu & H. Tsukaya 219A* (Holotype BO, dried specimen).

Albino form of *E. elongata*, differing only in the coloration. Whole shoot is pale ivory.

We thank the Secretariat of Permissions for Foreign Research, the Ministry of Research and Technology, Republic of Indonesia (RISTEK), who kindly granted permission for our field research in West Kalimantan, and the Indonesian Institute of Science (LIPI) and the Betung Kerihun National Park office for kindly allowing our studies in Betung Kerihun National Park, West Kalimantan. We also thank Dr. Dedy Darnaedi of LIPI, Dr. Marlina Ardiyani and Mr. Ujang Hapid of Herbarium Bogoriense (BO), Mustarrudin, Suherman, Jon, Anong, Mazid, and Eddy for helping with the botanical surveys.

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Received March 19, 2012; accepted May 2, 2012